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(71) Applicant *(for all designated States except US)*: SAINT-GOBAIN PIPELINES PLC [GB/GB]; Lows Lane, Stanton-by-Dale, Ilkeston, Derbyshire DE7 4QU (GB).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: COWAN, Paul, Anthony [GB/GB]; 14 Vine Farm Close, Ilkeston, Derbyshire DE7 4NG (GB). STEVENS, William, Walter [GB/GB]; 11 Gordon Road, Borrowash, Derby DE72 3JX (GB).

(74) Agent: POWELL, Timothy, J.; Eric Potter Clarkson, Park View House, 58 The Ropewalk, Nottingham NG1 5DD (GB).

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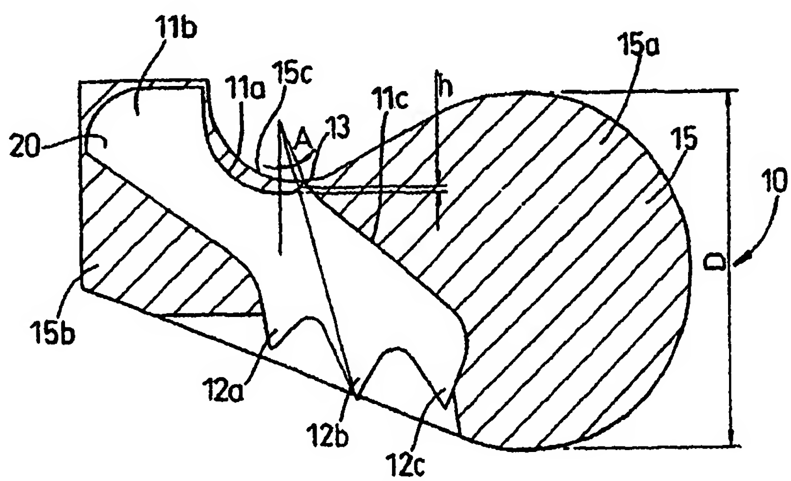
(54) Title: A GASKET FOR SECURING PIPES OR PIPE COMPONENTS



(57) Abstract: There is a need for a fluid pipe anchor gasket that exerts a reduced radial force on a spigot end inserted into a pipe socket. An anchor gasket (10) according to the invention includes an annular, elastomeric member (15) having secured therein a series a metal segments (11). The segments each have a concave portion (11a) on their upper sides. Each concave portion terminates in a contact point such as a cusp (13) that is of low height. This allows the metal segments (11) to pass under a bead (19) formed in the socket member, whilst maintaining positive engagement of the teeth (12) of the metal segment with the spigot end. This reduces the radial force, applied to the spigot by the teeth, whilst retaining an adequate axial force sufficient to prevent the pipes from separating in use.

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A GASKET FOR SECURING PIPES OR PIPE COMPONENTS

This invention relates to a gasket for securing pipes or pipe components to one another.

It is known to provide pipes, such as metal pipes for conveying liquids, with respective spigot and socket ends. The pipes are designed such that the spigot end of one pipe may be received in the socket end of an adjacent pipe to connect the pipes together. It is very common to connect a series of pipes and for pipe components in this way to create a desired pipe run.

It is necessary to seal the joint defined by each spigot end and socket end combination, against the pressure of fluid such as water conveyed in the pipes. It is known for the pressure in metal water pipes to reach 16 bar in use. The pipes typically have to pass tests in which they are pressurised to 21 bar.

Sealing of the joints is complicated by two factors:

There is a manufacturing tolerance inherent in the diameters of the spigot and socket ends. Consequently the annular gap between the spigot and socket ends varies from one combination of spigot and socket to another. The joints are designed to flex for ease of installation (i.e. they do not have to be laid in a perfectly straight line) and to reduce stresses in the pipeline arising from any ground movements/loads. Joint flexibility also allows the passive resistance of the soil to be mobilised for restraint when anchorage is required at changes in pipeline direction.

It is usual to form the free end of each socket end with a radially inwardly extending flange defining an inwardly facing annular shoulder spaced a short distance axially inwardly of the free end of the socket. An annular bead, e.g. of semi-circular profile, is formed a short axial distance further inward of the shoulder. The axial space between the shoulder and bead defines a groove known as a socket heel groove.

It is known to provide a seal that seats in or adjacent the socket heel groove to seal the joint between the pipes.

One form of seal, that performs dual functions of sealing the joint and preventing axial separation of the pipes, is known as a Tyton anchor gasket. A known Tyton anchor gasket 10 is shown in cross section in Figure 1.

In Figure 1 there is shown an annular elastomeric member 15 that is designed to seat about the socket heel groove and bead of a pipe socket end.

Elastomeric member 15 has a portion 15a of substantially circular cross section that blends into a heel portion 15b of substantially rectangular cross section. The transition between portions 15a and 15b is a concave curvature 15c that is substantially congruent with the profile of the annular bead. In use the heel portion of the elastomeric member 15 is received in the socket heel groove, while the annular bead seats in concave portion 15c and the substantially circular cross section portion seals the gap between the spigot and socket pipe ends.

A series of metal anchor segments 11 is secured in the elastomeric member about the annulus defined thereby. Each anchor segment 11 has

a series of radially inwardly directed teeth 12a, 12b that protrude inwardly of the elastomeric member 15 for engagement with the spigot end. The tips of the teeth are angled towards the free end of the spigot end. Thus in use of the Tyton anchor gasket 10 the teeth 12 engage the spigot end and resist any tendency for the spigot end and the socket end to separate from one another in the axial direction.

Radially outwardly of the teeth 12a, 12b the upper edge of each metal segment 11 is concave in a profile 11a similar to that of portion 15c of elastomeric member 15. Concave portion 11a terminates in a cusp 13 near the axially inner end of segment 11.

Cusp 13 is engageable with the annular bead. Since there is an annular gap between the inner diameter of the socket end and the outer diameter of the spigot end, the metal segment is moveable relative to the bead. Such movement occurs by deflection of the metal segment with the cusp in engagement with and moving around the bead.

Each segment 11 includes a heel portion 11b that is of similar shape to the shape of heel portion 15b of elastomeric member 15.

By virtue of the shape of the segments 11 and the elastomeric member 15, the known Tyton anchor gasket 10 can accommodate some variations in the annular gap as outlined above. Segment 11 moves in the direction of arrow A in Figure 1 on insertion of the spigot into the socket. This causes the segment to seat more fully onto the bead and socket heel groove and thereby present a low profile. On pressurisation of the pipe (which tends to withdraw the spigot from the socket) segment 11 moves in the direction of arrow B in Figure 1 to present a higher profile and thus perform its sealing and anchoring functions. The larger the annular gap

between the spigot and socket, the greater will be the movement in the direction of arrow B on pressurisation of the pipe.

Although the known Tyton anchor gasket has been successful, it nonetheless suffers some disadvantages. Principal among these is the tendency for the Tyton anchor segments to over-stress the spigot end when the fluid pressure in the pipe increases.

This arises because once the segments have engaged the socket bead, on assembly of the pipe joint, fluid pressure rotates the segments around the socket bead. This rotation increases the radial component of the restraining force and leads to the teeth 12a, 12b corrugating or fracturing the spigot.

The Tyton anchor has a limited pressure thrust capability. At small pipe diameters the pressure ratings are more than adequate to accommodate the working pressure but as the diameter increases the pressure rating decreases. At the pipe diameter known as 'DN400' the working pressure limit is only 10 bar. This is because the number of teeth in the metal segments can only increase in proportion to the pipe diameter whereas the pressure thrust increases in proportion to the square of the pipe diameter.

EP-A-0596394 discloses a segment having a rear tooth that prevents segment rotation by engaging the upstanding wall 18 of the socket heel groove 17 of the socket end 14.

This design of segment is shown in Figure 2, in which the heel portion 11b of the metal segment terminates in a sharp tooth 22 that points towards the upstanding wall 18.

Engagement of tooth 22 with the upstanding wall 18 prevents rotation of the segment beyond a predetermined point. However it is believed that once such engagement of the tooth 22 occurs the segment cannot further adjust its position if the spigot 16 deflects under pressure, e.g. due to ground movement after installation of the pipes underground.

GB-A-2018924 discloses a segment design, similar to that of EP-A-0596394, in which the heel portion of the segment is radiused to prevent the jamming of the segment that may arise in the EP-A-0596394 arrangement. However it is clear that the heel portion of the segment in GB-A-2018924 only engages the socket heel groove when there is a maximum annular gap between the spigot and socket ends.

DE-A-2606643 discloses an arrangement that attempts to reduce the radial force acting between the segments and the pipe members. However, this design seems to suffer from the same disadvantage as the arrangement of GB-A-2018924 in that prevention of rotation apparently only occurs at a maximum annular gap.

Also the DE-A-2606643 segment only seems to function over a limited range of annular gaps. This is because the engaging parts of the metal segment and the heel groove are defined by perpendicular surfaces in each case, thereby limiting the possible range of effective movements.

Thus there is a need for a gasket, that functions both to seal a pipe joint and to prevent axial separation of the joint parts; and that exerts a reduced force on the spigot end at least for large annular gaps, while simultaneously permitting adjustment of the position of the segments over a large range of annular gaps.

According to a first aspect of the invention there is provided a gasket as defined in Claim 1.

The use of a low cusp height as defined in Claim 1 ensures that when the gasket is designed as a Tyton anchor gasket (in which manufacturing tolerances are small) the heel portion of the metal segment engages the upstanding wall of the socket heel groove for all annular gaps greater than or equal to the mean. The gasket of the invention can equally well be employed in anchors other than the Tyton type, and which may be associated with greater manufacturing tolerances. In such applications the heel may engage the wall, e.g. when the annular gap is at or close to its minimum. In other words the cusp height is low enough to allow the segment to deflect under the socket bead, but large enough to ensure positive engagement of the spigot before and after such deflection.

Preferably the said distance, between the apex of the cusp and the most recessed part of the adjacent recess, is sufficiently small as to permit the entire segment to move, in use of the gasket, between the annular bead and the spigot end. This allows effective minimisation of the radial force.

Conveniently the said distance, between the apex of the cusp and the most recessed part of the adjacent recess, is sufficiently large as to ensure engagement between the segment and the bead when the segment is supported by the spigot end.

Thus the segment may remain in contact with the bead throughout any movement.

In preferred embodiments the heel of the segment includes a portion shaped to permit relative movement between the heel and the socket heel

groove while the heel engages the said wall of the socket heel groove. In particularly preferred embodiments the shaped portion is convexly radiused and is engageable with the said wall.

These features advantageously avoid the problem, inherent in the arrangement of EP-A-0596394, of the rear tooth of the segment jamming in the upstanding wall.

Conveniently the distance between the apex of the cusp and the extremity of the heel remote from the cusp is such as to permit deflection of the segment towards the said wall of the socket heel groove until the cusp is at or near the tip of the socket bead.

This advantageously minimises the reaction angle and hence the radial force exerted on the spigot end.

Preferably the elastomeric member includes a bulb portion of substantially circular cross-section; and the or each metal segment includes a forward tooth, located at an end of the segment remote from the socket heel groove in use of the gasket, positioned such that the mean distance L from the contact point to the engaging tip of the tooth is defined by the relation $L=0.75D$, where D is the diameter of the bulb portion, whereby to provide a large lever arm between the socket bead and the tip of the forward tooth when the annular gap between the spigot end and the socket is maximal.

This has the beneficial effect, when the annular gap is a maximum, of maximising the lever arm constituted by the segment and hence reducing further the radial force.

In preferred embodiments the heel of the segment includes a portion shaped to permit the heel to engage the socket heel groove at a level radially inward of the level of the tip of the socket bead. This has also been found to reduce the radial force.

Preferably the elastomeric member is of a single, uniform hardness.

This advantageous feature arises because the metal segments are effective at preventing the gasket from becoming dislodged from the socket bead on insertion of the spigot. The metal segments are also effective at preventing the gasket extruding between the socket mouth and the spigot.

The invention also resides in a metal segment for a gasket as defined herein.

There now follows a description of preferred embodiments of the invention, by way of non-limiting example, with reference being made to the accompanying drawings in which:

Figure 1 is a cross sectional view of a conventional, prior art Tyton anchor gasket;

Figure 2 is a cross sectional view, showing the metal segment of EP-A-0596394 in position in a socket heel groove but omitting the elastomeric member;

Figure 3 is a cross sectional view of a gasket according to the invention;

Figures 4A - 4C show the position of a metal segment of the gasket of Figure 3 when in use when there is respectively a minimum annular gap,

a mean annular gap and a maximum annular gap between a chosen spigot and socket end;

Figures 5A - 5C show views, similar to Figures 4, for an alternative embodiment of the segment; and

Figure 6 is a cross-sectional view of a further embodiment of the invention.

Referring to Figure 3 there is shown an annular gasket 10, according to the invention, for use in sealing and securing together two pipes respectively having a spigot end insertable into a socket end. The gasket 10 includes an annular elastomeric member 15.

Elastomeric member 15 includes a substantially circular cross section sealing portion 15a that blends into a heel portion 15b whose cross section is a chamfered rectangle as shown.

Intermediate the circular and rectangular parts the transition zone 15c of the member 15 is concavely curved to a profile corresponding to that of the bead 19 (Figures 4 & 5) of the socket end 14 into which the gasket 10 is insertable.

The gasket 10 also includes a series of metal segments 11 secured within and distributed round the annular member 15.

Each segment 11 has a plurality of teeth 12a, 12b, 12c that extend towards the centre axis of the socket end, for engagement with the spigot 16. In the embodiment shown the teeth 12a, 12b, 12c protrude through the elastomeric member 15.

Each metal segment 11 includes a heel 20 that is remote from the teeth 12a, 12b, 12c. Heel 20 is engageable with the wall 18 of the socket heel groove 17.

Intermediate the heel 20 and the teeth 12 the segment 11 is formed as a concave portion 11a that terminates at its forward end in a cusp 13. Cusp 13 defines the transition in the segment 11 from a curved profile to a substantially flat profile in the region 11c visible in Figure 3.

The bead 19 acts as a fulcrum about which cusp 13 pivots when the gasket 10 is in use.

The distance h between the apex of cusp 13 and the most recessed part of concave portion 11a, measured in the direction perpendicular to a tangent to the said most recessed part, is sufficiently small that the heel 20 engages the wall 18 for all degrees of tilt of the segment 11 greater than or equal to the tilt corresponding to the mean annular gap between the spigot and socket ends that the gasket 10 is in use to seal.

In other embodiments the distance h and other dimensions of the metal segment may be chosen so that the heel 20 engages the wall 18 for degrees of tilt corresponding to less than the mean annular gap.

Figure 4 shows the action of segment 11 of Figure 3 when the gasket 10 is in use to seal and retain a pipe joint.

Figure 4A shows the segment 11 in use when the annular gap G is less than the mean annular gap between the spigot 16 and socket 14.

In this situation the flange 23 of the socket end is in contact with the spigot 16, signifying that the socket 14 and spigot 16 are as close together as possible.

In Figure 4A the segment bead 19 of the socket 14 is received in the concave portion 11a, which seats snugly about the bead 19. The teeth 12a and 12b are in engagement with the outer surface of the spigot 16. Thus if the pipe portions tend to separate from one another in the direction of the arrows C the teeth 12a, 12b prevent actual separation from occurring.

Although not visible in Figure 4A, the circular section part (known as the "bulb") of the elastomeric member 15 is received in the gallery 24 that lies axially inwardly of the bead 19. In this position the elastomeric member seals the joint.

In Figure 4B the annular gap G has increased to the mean, primarily as a result of manufacturing tolerances. The increase can also arise by virtue of e.g. deflection of the pipes under a load caused by ground movement.

As is clear from Figure 4B the cusp 13 has pivoted around the bead 19 while the tooth 12b remains in contact with the spigot outer surface. The bead 19 is no longer seated in the concave portion 11a.

Thus it is clear from Figures 4A and 4B that the cusp height is sufficiently low as to permit the segment 11 to deflect under the bead 19. The cusp height h is on the other hand sufficiently high that the segment positively engages the spigot 16.

When the annular gap G is at the mean level, the heel 20 engages the wall 18. This is preferably achieved through judicious choice of the

dimensions of the segment and socket portions. The correct dimensions may be determined by the Tyton gasket (i.e. without inserts). Dimensions of the inserts can be determined by striking a radius of length 'r' from the cusp 13 of the insert when the dimension 'r' of the socket is on the mean. In contrast, in Figure 5 (described below) the radius has been struck from a point below the cusp.

The heel 20 is radiused over a part of its outer surface. In other words the heel 20 includes a radiused portion that terminates in a substantially planar portion as shown. This permits the heel to move relative to the wall 18 even after the heel 20 has engaged the wall.

Thus the detrimental effect evident in the segment of EP-A-0596394 does not arise.

Figure 4C shows that with a further increase in the gap G the segment deflects further around the bead 19, until the cusp 13 is at or near the tip of the bead 19.

This is achieved through the choice of the dimension r, that is the distance from the heel 20 to the cusp 13 measured in a direction parallel to the spigot 16. If dimension r is long enough, cusp 13 will reach its maximum extent of travel around the bead 19 at the tip or most protruding part thereof.

The dimension r may be similarly determined in all embodiments of the invention, if desired.

This has been found to minimise the reaction angle and hence the radial force.

Figure 4C demonstrates that the heel 20 is able to continue to move relative to the wall 18 after these components have engaged one another. Thus the segment 11 can accommodate further increases in annular gap arising from deflection or eccentricity of the spigot relative to the socket.

In the Figure 4C position the teeth 12b, 12c are in engagement with the spigot 16. Tooth 12a is out of engagement with the spigot.

The tooth 12c is positioned as far forward as possible in order to maximise the length of lever arm L indicated in Figure 4C. This also reduces the radial force.

As illustrated in Figure 3, the cusp angle A, that defines the cusp height h, is in preferred embodiments 6°. The bulb of the elastomeric member has a diameter D. In preferred embodiments the mean length L (shown in Figure 4C) is given by $L=0.75D$

It is believed possible to seal and anchor e.g. 600mm ductile iron pipes experiencing internal working pressures up to 16 bar and test pressures of up to 21 bar using the apparatus of Figure 4.

The Figures 5 show a second embodiment of segment for use in a gasket according to the invention.

The Figure 5 segment is similar to the Figure 4 segment, except that the heel 20 is radiused over the whole of its end surface that may contact the wall 18. The curved heel surface extends to a lower point in this embodiment, to ensure that there is a sufficient curved surface for all possible engagement angles with the wall of the socket heel groove. Also

in this embodiment the radius 'r' is struck from a point slightly below the cusp 13, to ensure that the heel engages the wall at a level below the cusp.

This allows the heel 20 to engage the wall 18 at a lower position (i.e. at a position closer to the centre axis of the socket pipe) than is the case in the Figure 4 arrangement. This has been found further to reduce the radial force.

Referring now to Figure 6 there is shown another embodiment of the invention, including two further, optional features that may be included separately or together in the same segment 11.

In Figure 6 the cusp 13 of Figures 3 to 5 is replaced by a flat 13a. Flat 13a makes a tangential (point) contact with the bead of the socket heel groove, that is similar to the point contact of the cusp in Figures 3 to 5. However, the flat 13a provides such point contact (i.e. it sits "on top" of the bead) over a wide range of annular gaps. Thus the flat 13a is useful in e.g. non-Tyton anchors, that suffer greater tolerances than the Tyton design.

Figure 6 also shows a recess 11a' that is of generally trapezoidal profile, instead of the arcuate profile of Figures 3-5. Other recess shapes/profiles are also possible.

In all embodiments the elastomeric member can be manufactured entirely from a single hardness material. Thus there is no need for a high stiffness portion as is sometimes called for in the prior art.

In its simple form the invention resides in a segment having the characteristics defined in the claims and/or described herein.

CLAIMS

1. A gasket for securing together first and second pipe components having, respectively, a spigot end and a socket whereby the spigot end of the first said pipe component is receivable in the socket of the second said pipe component to define a pipe joint, the socket including:

(i) a pair of mutually juxtaposed annular walls longitudinally spaced from one another and from the free end of the socket to define an annular socket heel groove on the interior surface of the socket; and

(ii) an annular bead, located longitudinally inwardly of the socket heel groove and protruding from the interior surface of the socket, wherein the gasket comprises

(a) an annular, elastomeric member; and

(b) one or more metal segments secured to the elastomeric member and each having:

(i) a plurality of teeth, that extend towards the centre axis of the socket, for engagement with the spigot end of the first said pipe component; and

(ii) a heel, remote from the said teeth, for engagement with the socket heel groove, an engaging portion of the or each metal segment being shaped to engage the said bead when the elastomeric member is seated in the said socket end, such that the bead acts as a fulcrum for the or each metal segment, thereby permitting tilting of the metal segment around the exposed periphery of the bead when transverse relative movement occurs between the pair of pipe components, characterised in that the engaging portion of the metal segment includes a recess terminating in a contact point that is pivotably engageable with the bead, the distance between the contact point and the most recessed part of the adjacent recess, measured in a direction perpendicular to a tangent to the recess, is such that the heel of the metal segment engages a wall of the

socket heel groove for all degrees of tilt of the metal segment greater than or equal to the degree of tilt corresponding to the mean annular gap between the spigot end and the socket.

2. A gasket according to Claim 1 wherein the contact point is the apex of a cusp.

3. A gasket according to Claim 1 wherein the contact point is on a flat portion of the metal segment.

4. A gasket according to any preceding claim wherein the said distance, between contact point and the most recessed part of the adjacent recess, is sufficiently small as to permit the entire segment to move, in use of the gasket, between the annular bead and the spigot end.

5. A gasket according to any preceding claim wherein the said distance, between the contact point and the most recessed part of the adjacent recess, is sufficiently large as to ensure engagement between the segment and the bead when the segment is supported by the spigot end.

6. A gasket according to any preceding claim, wherein the heel of the segment includes a portion shaped to permit relative movement between the heel and the socket heel groove while the heel engages the said wall of the socket heel groove.

7. A gasket according to Claim 6 wherein the shaped portion of the heel is convexly radiused and is non-lockingly engageable with the socket heel groove.

8. A gasket according to any preceding claim wherein the distance between contact point and the extremity of the heel remote from the contact point is such as to permit deflection of the segment towards the said wall of the socket heel groove until the contact point is at or near the tip of the socket bead.

9. A gasket according to any preceding claim wherein the elastomeric member includes a bulb portion of substantially circular cross-section; and wherein the or each metal segment includes a forward tooth, located at an end of the segment remote from the socket heel groove in use of the gasket, positioned such that the mean distance L from the contact point to the engaging tip of the tooth is defined by the relation $L=0.75D$, where D is the diameter of the bulb portion, whereby to provide a large lever arm between the socket bead and the tip of the forward tooth when the annular gap between the spigot end and the socket is maximal.

10. A gasket according to any preceding claim wherein the heel of the segment includes a portion shaped to permit the heel to engage the socket heel groove at a level radially inward of the level of the tip of the socket bead.

11. A gasket according to any preceding claim wherein the elastomeric member is of a single, uniform hardness.

12. A gasket generally as herein described, with reference to or as illustrated in the accompanying drawings.

13. A metal segment for a gasket according to any preceding claim.

14. A metal segment comprising :

(i) a plurality of teeth, that extend towards the centre axis of the socket, for engagement with the spigot end of the first said pipe component; and

(ii) a heel, remote from the said teeth, for engagement with a socket heel groove, an engaging portion of the or each metal segment being shaped to engage a bead when an elastomeric member supporting the segment is seated in the a socket, such that the bead acts as a fulcrum for the or each metal segment, thereby permitting tilting of the metal segment around the exposed periphery of the bead when transverse relative movement occurs between a pair of pipe components, characterised in that the engaging portion of the metal segment includes a recess terminating in a contact point that is pivotably engageable with the bead, the distance between the contact point of the cusp and the most recessed part of the adjacent recess, measured in a direction perpendicular to a tangent to the recess, is such that the heel of the metal segment engages a wall of the socket heel groove for all degrees of tilt of the metal segment greater than or equal to the degree of tilt corresponding to the mean annular gap between the spigot end and the socket.

15. A metal segment generally as herein described, with reference to or as illustrated in the accompanying drawings.

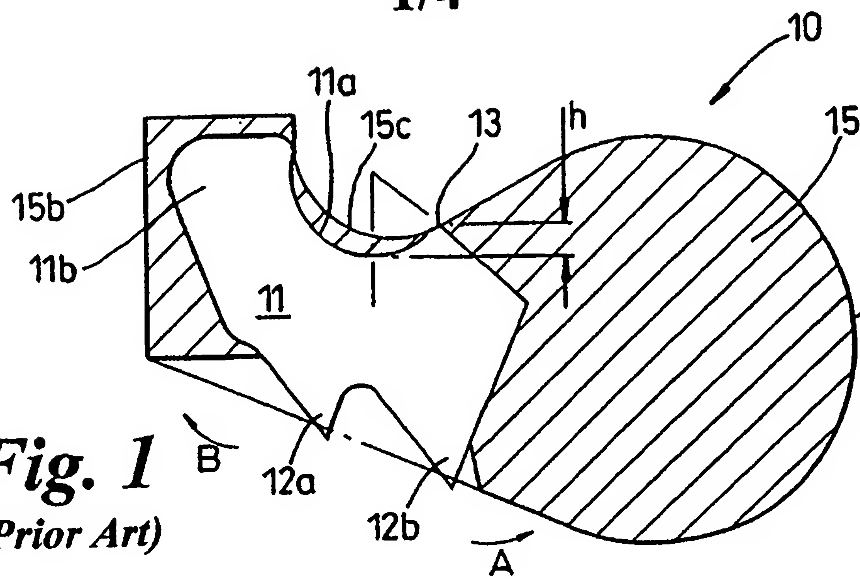

Fig. 1
(Prior Art)

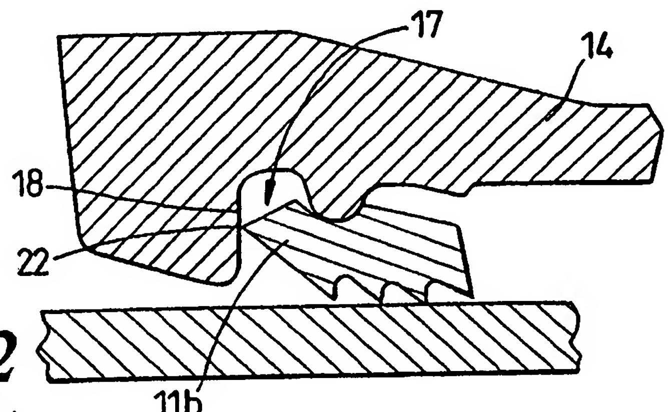

Fig. 2
(Prior Art)

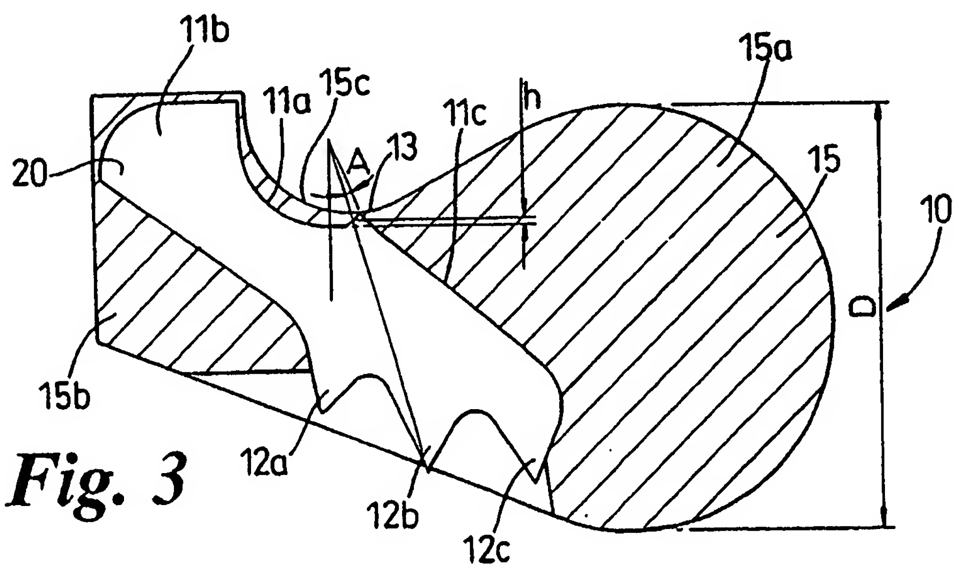

Fig. 3

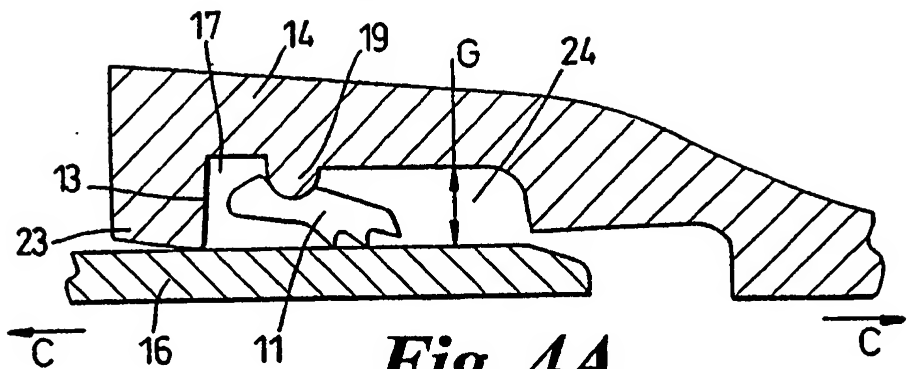

Fig. 4A

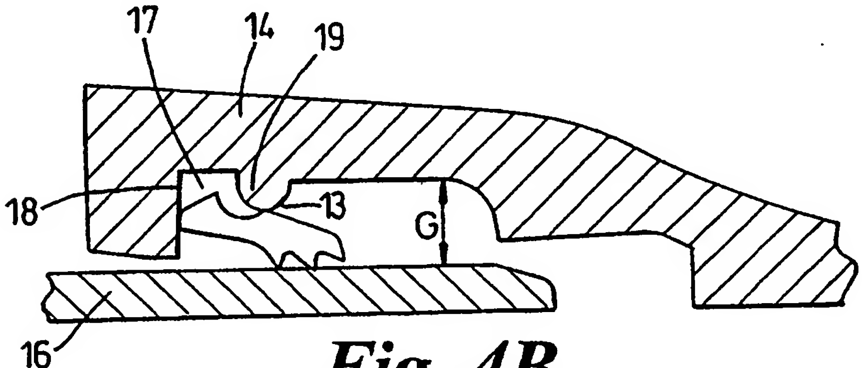

Fig. 4B

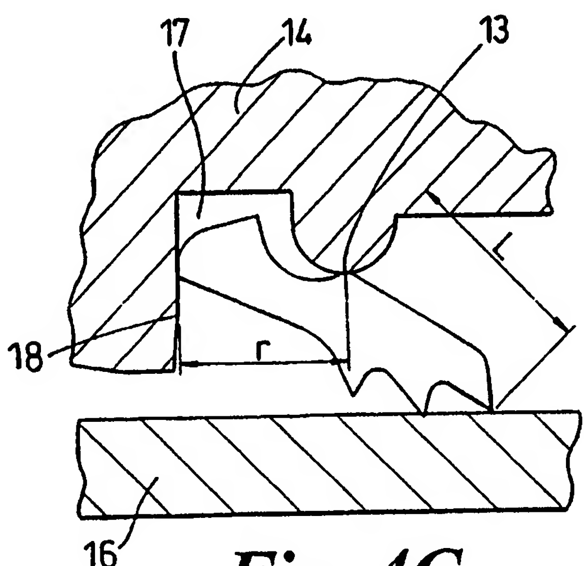

Fig. 4C

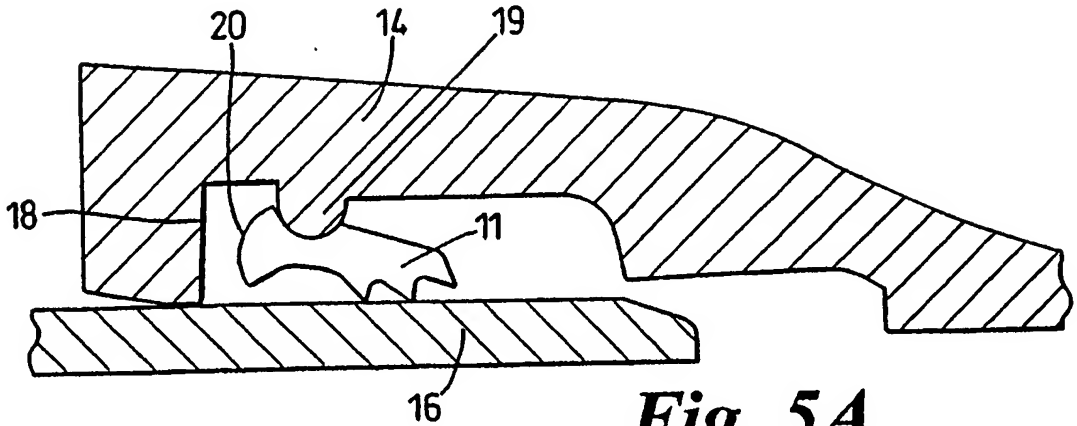

Fig. 5A

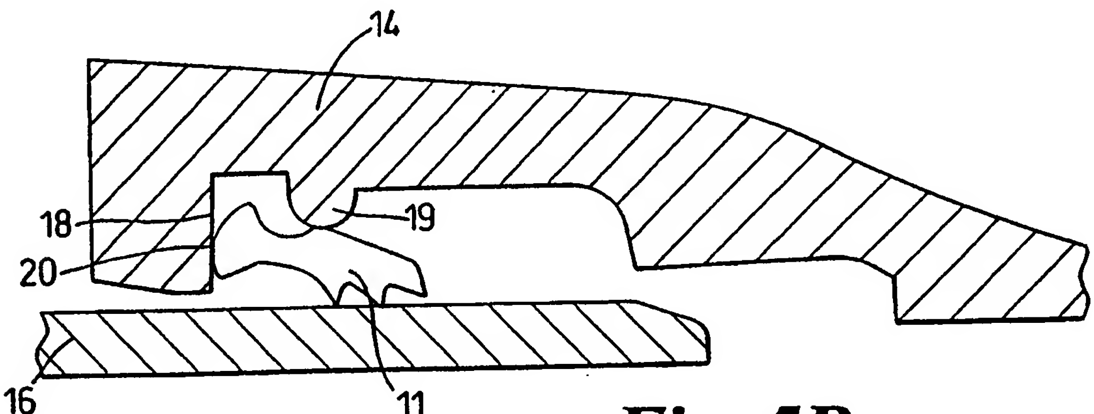

Fig. 5B

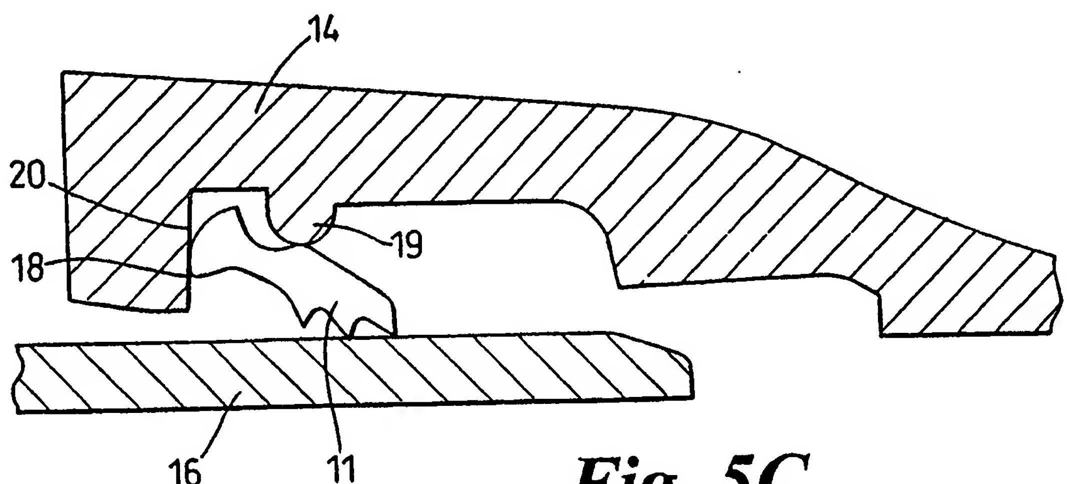

Fig. 5C

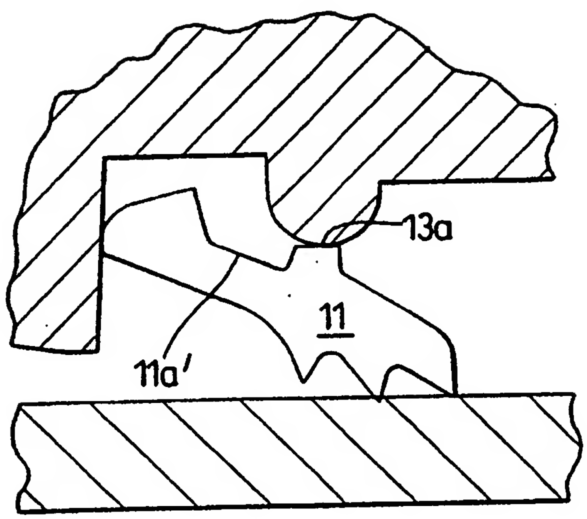

Fig. 6

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 00/02508

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 F16L37/084

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 F16L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 596 394 A (UNITED STATES PIPE FOUNDRY) 11 May 1994 (1994-05-11) cited in the application	1,2,4,5, 8,10,11
A	claim 7; figures	9
X	GB 2 272 264 A (VICTAULIC PLC) 11 May 1994 (1994-05-11)	1,2,4-8, 10,11
A	claim 1; figures	11
X	GB 2 018 924 A (DUEKER EISENWERK) 24 October 1979 (1979-10-24) cited in the application	1,2,4-8, 10,11
A	figures 1,3,4	9
A	DE 34 05 988 A (SEILER GEORG) 22 August 1985 (1985-08-22) figures	1,2,4-11

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 October 2000	25/10/2000

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Budtz-Olsen, A

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/GB 00/02508

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